

# Individual account investment options and portfolio choice: Behavioral lessons from 401(k) plans

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## Abstract

This paper examines how the menu of investment options made available to workers in defined contribution plans influences portfolio choice. Using unique panel data of 401(k) plans in the U.S., we present three principle findings. First, we show that the share of investment options in a particular asset class (i.e., company stock, equities, fixed income, and balanced funds) has a significant effect on aggregate participant portfolio allocations across these asset classes. Second, we document that the vast majority of the new funds added to 401(k) plans are high-cost actively-managed equity funds, as opposed to lower-cost equity index funds. Third, because the average share of assets invested in low-cost equity index funds declines with an increase in the number of options, average portfolio expenses increase and average portfolio performance is thus depressed. All of these findings are obtained from a panel data set, enabling us to control for heterogeneity in the investment preferences of workers across firms and across time.

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## 1. Introduction

Over two dozen countries around the world now include individual investment accounts as part of their public pension systems. Other countries, notably including the U.S., are also considering reforms that would allow individuals to directly invest part of their Social Security contributions in individual accounts. A key issue in designing such a program is determining what investment choices to offer individual participants. The simplest portfolio theory suggests that it is

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sufficient to provide a choice consisting of one portfolio of risky assets – the market portfolio – and one risk-free asset, and then to allow individuals to mix these two portfolios in accordance with their individual risk preferences. Most public and private plans in the U.S. and abroad, however, provide a large number and broad range of choices. For example, in the U.S., the vast majority of private sector defined contribution pension plans offer multiple investment options, often allowing individuals to choose from among several equity, bond, market and balanced fund options. Individuals also have thousands of mutual funds to choose from when allocating their non-pension portfolios. In Sweden, the Social Security system provides participants a menu of investment options that includes over 650 funds from which to choose.

The central question of this paper is whether the mix of investment options available to participants in an individual accounts program matters for portfolio allocation. In particular, we are interested in the “behavioral” response to the selection of fund options, over and above any “mechanical” link by which we mean changes that flow directly from adding or relaxing a binding constraint. For example, suppose an individual is prohibited from owning a particular asset class. It is clearly the case that this constraint will alter their portfolio choice if, in the absence of the constraint, the individual would have invested in this asset class. Instead, our focus is on the “behavioral” response, which might occur when a change in the menu of investment options leads to a large change in asset allocation, even though the investment opportunity set has not significantly changed. For example, imagine that an investor, faced with a choice between a diversified stock fund and a diversified bond fund, chose to allocate 50% of her portfolio to each fund. If this individual were provided a second diversified stock fund as a third investment alternative, then the overall investment opportunity set of this individual has not substantially changed because the additional stock fund is largely redundant of the first. In this case, standard portfolio theory suggests that this individual’s optimal allocation would still be close to 50% bonds and 50% stocks.

A growing body of evidence suggests, however, that many individual portfolio decisions may be influenced by plan design. For example, [Benartzi and Thaler \(2001\)](#) suggest that many people follow a “naïve” diversification strategy, such as evenly dividing contributions across all available assets (e.g., a “ $1/n$ ” strategy). If this is the case, then simply changing the relative number of stock and bond funds may alter the allocation of an investor’s portfolio between stocks and bonds. If people behave in this way, then firm managers or policymakers who are charged with determining the set of investment options to make available to participants in a corporate or government individual accounts program should consider how the choice of fund options will influence individual portfolio allocations.

The private pension system in the U.S. – in particular, 401(k) plans, which are now the single most common private pension in the U.S. – provides a useful research laboratory with which to learn about these issues. Because plan sponsors have significant leeway in choosing which investment options to make available, there is considerable time series and cross-sectional variation in the set of investment opportunities facing 401(k) participants. Using a rich panel data set on fund options and fund contributions to 401(k) plans during the 1990s, we examine several issues in this paper related to how the structure of investment options within a plan affects participant diversification. Unlike past work in this area that focuses on cross-sectional analyses, we are able to exploit the panel nature of our data to control for differences in the investment preferences of workers across firms and over time to better identify the effect of a change in 401(k) plan characteristics on participant behavior.

We focus primarily on how the set of investment alternatives affects portfolio diversification. While some prior research has suggested that overall portfolio diversification is affected by the

menu of options (Benartzi and Thaler, 2001), Huberman and Jiang (2006) highlight some of the difficulties in making inferences about individual behavior based on plan level data. For example, even if there is evidence at the plan level that contributions are divided roughly evenly across plan options, this could be because individuals are each following a  $1/n$  strategy,  $1/n$  of the individuals are each concentrating their portfolio in one option, or other intermediate combinations. Nonetheless, in considering the set of investment options to make available to individuals through a large national pension system, the effect of the plan choice set on aggregate portfolio allocations is of substantial interest.

Our data allow us to do a more comprehensive examination of plan level portfolio responses both within and across multiple asset classes over many years. We find evidence that the allocation of contributions is significantly affected by the number and mix of investment options available, even after accounting for plan-level fixed effects. For example, our estimates suggest that by increasing the share of equity funds from  $1/3$  to  $1/2$  (such as by adding an additional equity fund option to a plan that already offers company stock, one equity fund, and one bond fund), overall participant allocations to equity funds increase by 7.5 percentage points. We find similar strong effects for allocations to bond funds and balanced funds. Given that the fraction of equity options in the plan tends to increase substantially and the fraction of bond options tends to decrease substantially as plans offer more options over time, this leads to 401(k) participants taking on greater risk in their retirement portfolios with their higher equity allocations.

We also address how the composition of actively versus passively managed fund options has affected allocation decisions within 401(k) plans. From 1990 to 2003, the number of mutual funds available to investors in the U.S. rose from 3100 to 8100, with the dramatic growth in actively-managed equity funds (which quadrupled over the period) accounting for nearly 70% of the total increase (Investment Company Institute, 2005). Consistent with this, we find the vast majority of the new funds added to 401(k) plans are also high-cost actively-managed equity funds as opposed to lower-cost equity index funds. For example, actively-managed equity funds represent nearly  $2/3$  of the new funds added to 401(k) plans in our sample over the period 1998–2002, while index funds represent only 8 percent of the new funds added. This result has strong implications for the relation between the investment performance of these retirement plans and the composition and number of fund options provided. For example, we estimate that a move from a plan with only index funds to a plan with only actively-managed funds is associated with a 35 basis point increase in the annual plan-wide expense ratio paid by participants (as participants are investing more in higher-cost funds which are much more likely to be added on the margin). Given historically that actively-managed funds do not outperform index funds (even before expenses), these investment patterns (coupled with actively-managed funds being much more likely to be the marginal fund added to the plan) could result in a nontrivial reduction in resources available for retirement.

While not the main focus of our paper, we also address the importance of firm-level heterogeneity and investment restrictions upon the investment behavior of 401(k) participants. A concern with any of the past cross-sectional analyses that have documented a strong relation between plan parameters and participant decisions is that an omitted factor such as differences in either the firms or the workers across firms could explain both the design of the 401(k) plan as well as the workers' investment decisions (e.g., differences in the risk aversion or investment philosophy of workers across firms). Ruling out such an alternative explanation is essential for identifying what role the characteristics of the plan (as opposed to unobserved characteristics of the participants of the plan) play in influencing investment decisions and is thus essential for public policy purposes.

We present evidence that *both* plan parameters and firm-level heterogeneity are important determinants of how 401(k) assets are allocated across asset classes. For example, the number of equity and bond options in the 401(k) plan is an important predictor of contributions to equity and bond funds, respectively, even after accounting for firm-level fixed effects. On the other hand, while both the relation between the number of options in the plan and allocations to company stock and the “endorsement” effect found by Benartzi (2001)<sup>1</sup> are very strong in the cross section, they are substantially diminished once firm-specific effects are accounted for in the regression. This suggests that investments in company stock in pension plans appear to be driven in no small part by firm-level heterogeneity in the desirability of company stock investment, which manifests itself both in employee contributions to company stock, how many non-company stock options are present in the 401(k) plan, and employer match policy.

This paper proceeds as follows. Section 2 provides background information on the range of investment options offered in selected pension systems around the world, as well as in some U.S. reform proposals. We also review the relevant literature relating to the influence of investment options on portfolio allocation. In Section 3, we describe our data on 401(k) plans and provide some initial summary statistics about the range of investment options available. In Section 4, we provide evidence on how the number and mix of investment options influences the allocation of contributions in 401(k) plans. Section 5 demonstrates how trends in the mutual fund industry over the past decade such as the explosion of high-cost, actively-managed equity funds have affected 401(k) plans and participants. Section 6 concludes with a discussion of policy implications.

## 2. Background

### 2.1. Brief overview of range of investment options in public pension plans around the world

Over the past two decades, a large number of countries have incorporated individual accounts into their public pension systems. These countries span the globe, and include highly developed economies of Western Europe, transition economies from the former Soviet Union, and developing countries. A notable exception to this trend is the United States, whose public Social Security program is entirely a traditional pay-as-you-go, defined benefit system. Even in the U.S., however, proposals to introduce personal accounts as part of, or in addition to, the Social Security system have been forwarded by numerous commissions, think tanks, academics, members of Congress, and even the President.

The plans that have been implemented around the world, as well as those proposed in the U.S., vary along many dimensions, including account size, the source of funding, and the degree of access to funds before and during retirement, just to name a few. One particularly important difference is the degree of portfolio choice provided to individuals, particularly during the account accumulation phase. In general, architects of alternative plans have made different choices when faced with the trade-offs between allowing individual choice, ensuring some minimum level of portfolio diversification, and keeping administrative costs low. As a result, different plans provide very different degrees of choice.

At one end of the spectrum are plans that provide very limited choice. As discussed in a recent survey by the GAO, “initially, several countries offered individuals choice among a limited

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<sup>1</sup> Benartzi (2001) finds that workers in firms where the employer provides a match in company stock tend to invest substantially *more* of their own contributions in company stock and attributes this to the workers viewing a firm match in company stock as implicit investment advice.

number of investment options and often restricted the portion of assets that could be invested in certain products, such as publicly traded equities, private equities and foreign securities” (Government Accountability Office, 2005). For example, in Australia as of the late 1990s, the employer was generally given the authority to select the fund for the workers, and thus most workers had minimal choice in how to invest their retirement savings (Congressional Budget Office, 1999). Some U.S. reform proposals, such as Rep. Shaw’s “Social Security Guarantee Plus Act of 2003,” severely restrict choice. For example, Shaw’s plan would require individuals to hold all account assets in a single fund that can be changed at most once per year.<sup>2</sup> The default option would be a portfolio allocation of 60% stock index funds and 40% high-grade corporate bond index funds. The only two alternative options simply allow slight deviations in the allocations (65% stock/35% bonds or 70% stock/30% bonds). Another plan that starts out with tight restrictions on choice is the Rep. DeMint’s “Social Security Savings Act of 2003,” in which account balances would initially be maintained in a default portfolio with 65% in a specified broad index fund of equities of U.S. corporations and 35% in long-term bonds issued by the Federal government.<sup>3</sup>

At the other end of the spectrum are plans that provide an extraordinarily wide range of choice. In Sweden, for example, participants are able to choose from a menu of approximately 650 mutual funds (Palme et al., 2004). However, participants are restricted to selecting at most five funds from this extensive menu (Government Accountability Office, 2005). In the U.S. context, the Personal Security Account option (commonly referred to as the Schieber/Weaver plan) from the 1994–96 Social Security Advisory Council would have allowed virtually unfettered access to a broad universe of private sector investments.

In between these two extremes is a wide range of plans. For example, Mexico now has age-based investment options available. Chile requires each pension administrator to offer four types of funds with varying degrees of risk, including a higher risk fund and a fixed income fund (GAO, 2005). For younger workers, a fifth option (higher risk) is also available.

How does the degree of investment choice affect portfolio behavior? In some cases, the answer is obvious. For example, in the U.S. Shaw proposal mentioned above, individuals are clearly forced into one of three pre-specified combinations of equities and bonds. In most other cases, however, there are enough choices available that individual decisions about general asset allocations are not restricted. Even in these cases, however, the potential exists for the menu of investment options to influence participant decisions about how to invest their individual account balances. For example, if, as the number of investment options rises, the fraction of investments that are in actively-managed equity funds also rises, might this influence overall portfolio allocations?

The objective of this study is to provide empirical evidence on how the menu of investment options offered in an individual accounts system is likely to influence participant portfolio choices. We will do this by using data on private sector 401(k) plans, which like individual account programs around the world, are defined contribution retirement plans that provide participants with a specified set of investment options. We can use both the time-series and cross-

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<sup>2</sup> Details on Rep. Shaw’s proposal are taken from the January 7, 2003 memorandum to Rep. Shaw from the Social Security Office of the Chief Actuary “OASDI Financial Effects of the Social Security Guarantee Plus Act of 2003 (H.R. 75) — Information.”

<sup>3</sup> Once the individual account balance reaches a specified level, two additional investments are available — a broad index of small-cap equities and a broad index of mid-cap equities. Details on Rep. DeMint’s proposal are taken from the September 26, 2003 memorandum to Rep. DeMint from the Social Security Office of the Chief Actuary “Estimated Financial Effects of H.R. 3177, the Social Security Savings Act of 2003 — Information.”

sectional variation in the number and type of investment options available to employees to learn how portfolio allocation is influenced by plan parameters. Exploiting such data can help address the concern that firm-level differences in worker investment preferences may explain any cross-sectional correlations found. This is an area that has been receiving increased attention in the economics literature, which we now briefly review.

## 2.2. Literature on investment options and portfolio choice

Within a neoclassical economics framework, the number of investment options available to an investor should matter only insofar as it alters one's ability to diversify. For example, if participants in a defined contribution account were provided with bond investment options only, and no equity investment options, then their portfolio choices would be constrained in an obvious way. In reality, however, most 401(k) plans do not restrict investments in such an overt way. Rather, the typical 401(k) plan offers participants a range of funds that invest in equities and bonds and allow participants to cover a wide range of the risk/return spectrum. As such, in a world where all participants behave according to standard finance theory, the constraints imposed by the firm's choice of options are unlikely to have a first order effect on an individual's portfolio allocation across different asset classes.

Nonetheless, more recent "behavioral" research has shown that the composition of investment options selected by an employer can have a significant influence on participant portfolio allocation. For example, [Benartzi \(2001\)](#) and [Brown et al. \(2006\)](#) examine the effect of employer 401(k) match policy, and find that when employers restrict individuals to hold employer stock, employees tend to purchase *more* employer stock in their own accounts, rather than less, as would be predicted by standard portfolio models. Also, [Benartzi and Thaler \(2001\)](#) find evidence consistent with employees following "naïve diversification strategies," i.e., allocating  $e/n$  of their contributions to equities when there are  $n$  investment choices available,  $e$  of which are equity funds, while [Karlsson et al. \(2006\)](#) suggest that investors choose assets as a function of the way they are represented in the menu available to them.

Plan design can influence numerous other behaviors as well. [Huberman et al. \(2007\)](#) show that the availability of an employer match increases participation and contributions, especially among low-income employees. [Samuelson and Zeckhauser \(1988\)](#) and [Ameriks and Zeldes \(2001\)](#) show that investors are slow to rebalance portfolios, which can lead to allocations of total holdings that look very different than allocations of contributions. [Madrian and Shea \(2001\)](#), [Agnew et al. \(2003\)](#), and [Choi et al. \(2004a\)](#) document the importance of plan design and employee inertia as they show that many new plan participants invest in the plan's default investment option and are slow to move out of that option for potentially higher-return assets. [Agnew and Szykman \(2005\)](#) also provide evidence that individuals with below average financial knowledge become "overwhelmed" by making investment decisions.

## 3. Data

### 3.1. Data source

The primary source of data for this project is 401(k) plan level financial data from the 1990s. This rich source of data is compiled by hand from 11-k filings with the SEC, which a company files when it provides an option to invest in company stock that is deemed an offering of securities. From these filings, we collect information about the number and type of investment

Table 1  
Sample composition

Year	Number of observations	Number of years in sample	Number of firms	Number of observations
1991	29	1	211	211
1992	128	2	194	388
1993	240	3	166	498
1994	314	4	107	428
1995	398	5	86	430
1996	487	6	72	432
1997	537	7	40	280
1998	566	8	13	104
1999	65	9	1	9
2000	26	10	1	10
TOTAL	2790	TOTAL	891	2790

Data collected for all U.S. companies listed in Compustat any year from 1993 to 1999 that filed an 11-k at least once during 1994–2001, and for which complete fund classification was possible. See text for further details.

options offered. We categorize each investment option into one of five categories — company stock, equity funds (by which we precisely mean domestic equity funds excluding employer stock), international equity funds, bond funds (which includes money market, guaranteed investment contracts, government bonds, and corporate bond funds), and balanced funds. For each investment option, we collect total participant contributions, total employer contributions, and total assets. For the few firms with multiple plans, we collect data for the largest plan.

Starting with all U.S. firms listed in Compustat any year from 1993 to 1999, we identify firms that filed an 11-k at least once during this period.<sup>4</sup> We were able to hand-collect data for 891 companies for which we could accurately classify their investment options, yielding 2790 firm–year observations. As reported in Table 1, most of the data are in the period 1993 to 1998, with the largest number of firms, 566, in 1998. On average, there are just over three observations per firm, with 45% of the firms with two observations or less and 55% of the firms with three or more observations. In 1999, there was a change in ERISA reporting requirements that led to substantially fewer companies reporting contributions by asset category, leaving us with contribution data for far fewer plans in 1999 and 2000 than in 1998. The 1999 and later filings, while lacking good contribution data, still provide asset balances. We will make use of this data (and describe it more fully) to augment our sample when we examine the active vs. passive mutual fund choice below.

To characterize our initial sample, we focus on firms in the sample in 1998, one of the more recent years with the largest number of firms. As shown in Table 2a, about one-half of the sample was a member of the S&P 1500 during 1998.<sup>5</sup> Thus, the typical firm in our sample is smaller, measured by both market value and employees, than the typical S&P 1500 firm, but is larger than the average of all public companies as available from Compustat. The sample represents a broad cross section of industries. As noted in the Table, 15% of the sample is in the technology sector, somewhat less than the overall market.

<sup>4</sup> 11-k filings are available on the SEC's Edgar website starting in 1994. The 1994 filing reports plan activity during 1993. Some firms will report not only plan activity during the past year, but also plan activity over the past three years. Thus, we have 128 observations in 1992 and 29 observations in 1991.

<sup>5</sup> The S&P 1500 consists of the 1500 stocks that comprise the S&P 500 index, the S&P 400 MidCap index, and the S&P 600 SmallCap index.

Table 2a  
 Characteristics of 1998 sample, S&P 1500, and public firms

	1998 sample	S&P 1500	Public firms
Market value (\$ millions)			
Mean	6029	7283	2,438
Median	799	1329	192
[10th %–90th %]	[67–10,240]	[238–14,211]	[26–3260]
Employees (000s)			
Mean	13.9	19.9	5.4
Median	4.5	6.6	0.5
[10th %–90th %]	[0.5–32.3]	[0.9–45]	[0.02–10.2]
Member of S&P 1500 (%)	52	100	20
Technology sector (%)	15	19	24

Data for S&P 1500 and public firms are from Compustat. Public firms include 7501 U.S. firms.

Companies that issue shares for their retirement plan, rather than purchase shares on the open market, are required to file an 11-k. While this raises the possibility that the sample could be biased toward firms that do not repurchase stock, in separate work (Brown, Liang, and Weisbenner, 2006) we document that repurchase activity by firms in our sample does not differ from that at other publicly-traded firms.<sup>6</sup>

We also compare our sample of plans to those at publicly-traded firms as reported on Form 5500 filed with the DOL.<sup>7</sup> In the aggregate, for our sample of the largest plans at 566 companies in 1998, total plan assets were \$249 billion, representing 36% of the \$698 billion in plan assets at all publicly-traded companies (Table 2b). Total contributions by participant and company for our sample totaled \$13.9 billion, 28% of the \$49.2 billion for publicly-traded firms. Estimates from the DOL for 1998 for all US companies, public and private, are \$1.54 trillion in assets and \$135 billion in contributions.

As highlighted earlier, a key advantage to these data over data used in prior studies on portfolio options and investment allocations is that we have a panel comprised of companies with multiple years of plan information. As such, we are able to trace how changes in investment structure influence portfolio behavior over time, while controlling for cross-sectional differences in firms.

### 3.2. Summary statistics on fund options

In Table 3, we report the composition of plan options and employee contributions in 401(k) plans by the type of fund (i.e., company stock, domestic equity, international equity, bond, and balanced) across our pooled data 1991–2000. The average firm (across plans and years) provides 7.8 investment options, and the median firm has 7 funds. Over 80% of the firm–year observations offer between 4 and 12 options, inclusive.

Table 3 also shows substantial heterogeneity in the type of funds offered and contributions to the various asset classes. While domestic equity funds constitute only 29% or less of plan options at one quarter of the firm–year observations, they constitute at least half of the options at another

<sup>6</sup> In the uncommon event that the plan does not allow employees to purchase company stock but does provide the employer match in company stock, it would generally not be deemed an offer of securities, and the plan would not be required to file an 11-k. In our discussion with SEC staff, the onus is on the company to determine whether it needs to file an 11-k.

<sup>7</sup> Publicly-traded companies in the DOL Form 5500 data set were identified by whether they had a CUSIP and matching EINs with those in Compustat.

Table 2b

Aggregate 401-k plan assets and contributions for 1998 sample, public firms, and all firms

	1998 sample	Public firms	All firms
Total 401-k assets (\$ billions)	249	698	1541
Employee and employer contributions (\$ billions)	13.9	49.2	134.7

Data on 401-k assets for public firms are from 1998 5500 filings with the Department of Labor. Data for all firms (public and private) are estimated by the Department of Labor. Company stock for public firms and all firms excludes stock indirectly held in trusts and pooled accounts. Employer contributions constitute 29% of total contributions for the 1998 sample and 31% for all public firms.

quarter of the observations. The interquartile range for the share of bond funds in the 401(k) plan also spans 20 percentage points (the 25th percentile is 20% of fund options while the 75th percentile is 40% of fund options). International funds and balanced funds are a small share of offerings for the majority of firms.

There are also striking differences across firms in the investment decisions made by participants in their 401(k) plans. While only 31% or less of employee contributions are allocated to domestic equities at one quarter of the firm–year observations, they constitute at least 58% of the allocations made at another quarter of the observations. There are also substantial differences in the investments in company stock and bond funds across firms.

Of course, if employees are not unduly influenced by the mix of options, for example by following an optimal portfolio strategy or by allocating according to a fixed allocation rule (e.g., a 60/40 equity/bond mix), then increasing the proportion of equity fund options should not have a large effect on the individual's overall equity exposure. In contrast, if the mix of options does influence behavior, as would be the case if participants follow a naïve  $1/n$  diversification heuristic (or alternatively “randomly” concentrate their contributions in a small group of funds), then we would expect to see higher equity allocations when more equity funds are available.

Table 3

Composition of plan options and employee contributions in 401(k) plans by fund type, pooled sample 1991–2000 data from 11-k forms

	Mean	10th percentile	25th percentile	Median	75th percentile	90th percentile
Total number of options in plan	7.8	4.0	5.0	7.0	9.0	12.0
Company stock fund	1.0	1.0	1.0	1.0	1.0	1.0
Domestic equity funds	3.1	1.0	2.0	3.0	4.0	6.0
International equity funds	0.7	0.0	0.0	1.0	1.0	1.0
Bond funds	2.3	1.0	2.0	2.0	3.0	4.0
Balanced /life cycle funds	0.7	0.0	0.0	1.0	1.0	1.0
Share of options in plan (in %)						
Company stock fund	15	8	11	14	20	25
Domestic equity funds	38	20	29	38	50	56
International equity funds	8	0	0	8	14	17
Bond funds	31	17	20	29	40	50
Balanced /life cycle funds	9	0	0	8	15	20
Share of employee contributions allocated to fund type (in %)						
Company stock fund	19	3	7	14	26	43
Domestic equity funds	44	20	31	45	58	68
International equity funds	4	0	0	1	7	13
Bond funds	26	8	14	22	35	48
Balanced /life cycle funds	7	0	0	2	12	21

See text for further information.

#### 4. How the number and mix of investment options influence portfolio decisions

##### 4.1. Composition of investment options and investment choices by number of funds

Fig. 1 enables us to examine, over the pooled sample 1991–2000, how the share of options in a particular asset class changes as the total number of options in the plan increases. We find that as firms increase the number of options available to employees, the increase is predominantly concentrated in equity funds. For example, an increase in total options in the 401(k) plan from 4 to 12 is associated with an increase in the share of domestic equity funds in the plan from just over one quarter of options to almost half of options (at the same time, the share of both the bond funds and the company stock fund in the plan fall by roughly 15 percentage points each).

Fig. 1 also reports how the share of funds matches up with the share of contributions to those funds (numbers are reported in percentage points). Across all asset types, there is a striking relation between the share of fund options available in each asset class and the share of contributions made to funds in that asset class. Mirroring the pattern with the share of options, the share of contributions made to company stock and bond funds fall as the total number of options in the 401(k) plan increase, while the share of contributions to domestic equity funds rises dramatically as the number of options in the plan increases. For example, as we move from a total of four fund options to a total of twelve, the fraction of contributions made to equity funds rises from 30% to 56% (mirroring the increase in the fraction of equity funds from 28 to 47%). Though increasing, allocations to international funds seem to be lagging behind their increased prominence in 401(k) plans as the number of options expands.

Thus, Fig. 1 provides initial evidence that employees may be influenced in their overall portfolio allocation behavior by the mix of investment choices provided to them. Specifically, as employers provide more options, they appear to be doing so primarily by adding additional domestic equity funds (and to a lesser extent international funds). Correspondingly, participants

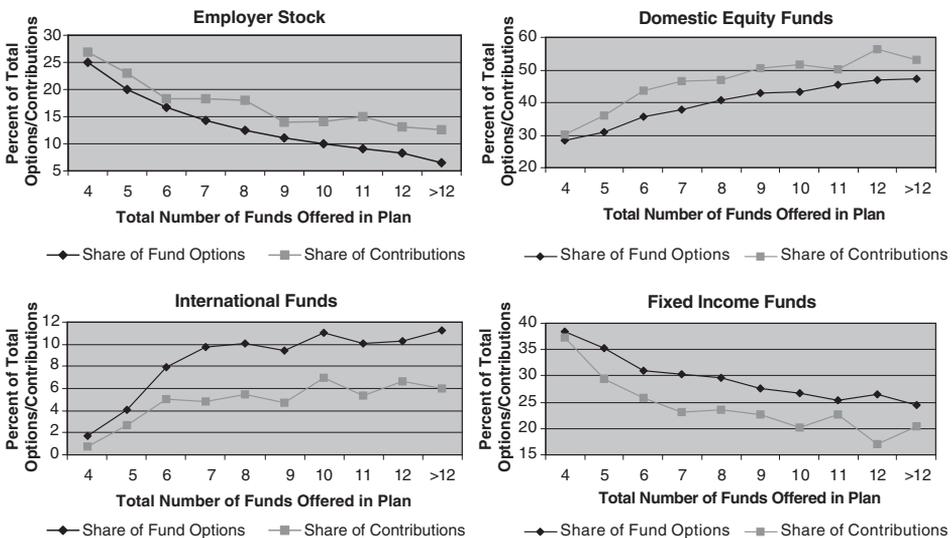


Fig. 1. Average share of fund options and share of contributions by asset type and total number of funds in plan.

appear to be placing a higher fraction of their portfolio in equities as the fraction of equity options rises. However, clearly other factors, such as asset returns, also affect allocation decisions within the plan. Further, the correlation between the share of options and the share of contributions need not be causal, as it could simply reflect firms with risk-averse workers do not invest in equities and thus demand fewer equity funds in their 401(k) plans. To address these concerns, we turn to a regression framework.

#### 4.2. Regression framework

We begin by estimating pooled cross-sectional regressions in which the dependent variable is the share of contributions allocated to each of our five investment categories. On the right hand side, our primary variable of interest is the fraction of investment options that are in this category. Thus, when testing for employer stock, we regress the share of contributions to company stock against  $1/n$ , which represents the share of total investment options that are comprised by the employer stock fund. For domestic equity funds, we regress the share of contributions against  $e/n$ , where  $e$  is the number of domestic equity funds and  $n$  is the total number of investment options. We follow a similar approach for international equity funds, bond funds, and balanced funds.

If the coefficient on the share of fund options is zero, it indicates that individual portfolio allocations are not influenced by the mix of investment choices available. At the other extreme, a coefficient of one suggests that individuals, *on average*, follow a “ $1/n$ ” strategy, implying that the mix of investment options translates nearly one-for-one into changes in portfolio allocations. Significant intermediate results would indicate that the mix of investment choice clearly matters, though not to the full extent predicted by a strict  $1/n$  hypothesis.

There are at least two possible explanations that are consistent with there being a positive relation between contribution shares and the share of options. The first possibility is that all workers naively diversify across multiple options and thus an increase in the number of options would reduce all workers’ allocations to company stock. A second possibility is that workers randomly put their entire 401(k) portfolio in one option, with different workers concentrating their purchases in different options, in which case an increase in the number of options would reduce the fraction of workers that concentrate all of their holdings in company stock. Benartzi and Thaler (2001) provide evidence of the former and Huberman and Jiang (2006), Agnew (2006), and Holden and VanDerhei (2001) provide evidence for the latter, suggesting that both types of investors may exist. With plan-level rather than worker-level data, it is not possible for us to distinguish which of these two stories is driving the result.

Besides the composition of options in the 401(k) plan, we also control for several other firm/plan characteristics as well as year effects in our regressions. To do this, we merge our sample of 11-k filings with Center of Research in Security Prices (CRSP) and Compustat data. Motivated by Benartzi (2001), we include in our regressions a binary variable for whether the firm restricts its employer match to company stock. We also control for past five-year returns on the employer’s stock (taken from CRSP), the company’s stock price volatility (measured as the standard deviation of total returns over the past 24 months), market-to-book ratio, log of plan assets, whether the firm has a defined benefit plan, whether the firm’s bonds are investment grade as a proxy for bankruptcy risk, and year effects.

Including year effects are important for two reasons. First, given the unbalanced nature of our panel, as discussed in Table 1, it is important to ensure that the “naïve diversification” results are not being driven by differences in market returns. For example, if firms increase the number of options over time, in our sample this corresponds with a period of rising equity markets. Thus it is

important to ensure that the results are not being driven by individuals placing more money into equity funds in response to rising equity markets (this effect will be absorbed in the year effects in our regression). Second, it is likely that the increase in the number of investment alternatives over time was due in large part to the proliferation of different types of mutual funds offered over the past decade. For example, the ICI reports that the total number of mutual funds rose from 3403 in 1991 to 8155 in 2000 (Investment Company Institute, 2005), with the vast majority of these funds being equity funds. Year effects will pick up this potential “demand” for equities as manifested by greater fund offerings.

#### 4.3. Cross-sectional regression results

Table 4 displays the results of the pooled cross-sectional regressions of the share of employee contributions in a particular asset class against the share of fund options in this same class using our sample of 401(k) plans over the period 1991–2000. Regressions are estimated separately for each asset class and are only estimated over firm–year observations that offered at least one option of that particular type in their 401(k) plan. For all five asset classes, we find positive and significant relations between the share of contributions and the share of options in the plan, confirming that the patterns displayed in Fig. 1 also hold in the presence of firm-specific characteristics and year controls. For domestic equity funds, the coefficient on the share of equity options in the plan is

Table 4  
Regression of share of contributions against share of fund options, pooled cross sections 1991–2000

	Share of contributions in:				
	Company stock fund	Domestic equity funds	International equity funds	Bond funds	Balanced funds
Share of fund options in asset class	0.850*** (0.129)	0.703*** (0.048)	0.533*** (0.069)	0.265*** (0.050)	0.494*** (0.117)
Co stock match required?	0.070*** (0.014)	-0.021* (0.011)	-0.005 (0.005)	-0.032*** (0.012)	-0.029*** (0.009)
Past 5 year return on company stock	0.005* (0.003)	-0.003*** (0.001)	0.001* (0.001)	-0.002 (0.002)	-0.000 (0.001)
S.D. of co. stock	-0.467*** (0.156)	0.089 (0.140)	0.133* (0.073)	0.328** (0.155)	0.022 (0.130)
Market-to-book ratio	0.013*** (0.005)	-0.003 (0.005)	-0.002 (0.002)	0.009*** (0.003)	-0.007*** (0.002)
Ln (assets)	0.030*** (0.005)	-0.020*** (0.003)	-0.007*** (0.002)	0.002 (0.004)	-0.010*** (0.003)
DB plan?	-0.018 (0.013)	0.016 (0.013)	-0.001 (0.006)	0.010 (0.012)	-0.013 (0.010)
Inv. Grade Bonds?	-0.017 (0.018)	-0.017 (0.011)	-0.008 (0.006)	0.017 (0.014)	-0.001 (0.011)
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects?	No	No	No	No	No
Adjusted R <sup>2</sup>	0.272	0.477	0.271	0.321	0.244
# of observations	1935	1900	1045	1911	1065

\*, \*\*, and \*\*\* denote significance at the 0.10, 0.05, and 0.01 level respectively.

Each column of this table represents a separate regression. The dependent variable is the share of contributions allocated to a particular asset class, and the regression is estimated for the sample of firms that offer at least one option in that asset class. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm. See text for further information.

0.70. To assist in the literal interpretation of this coefficient, imagine a firm has five investment options available, three of which are equity funds and two of which are fixed income funds. If the firm added another equity option, the share of equity choices changes from 3/5 to 4/6, or an increase of 6.7 percentage points. Multiplying by the 0.70 coefficient implies that participants would be expected, on average, to increase their allocation to equities by 4.7 percentage points. For company stock investments, we cannot reject the “ $1/n$ ” hypothesis (i.e., cannot reject a coefficient of one on the share of options). This would suggest, at first glance, that the trend of adding more options to 401(k) plans has contributed considerably to a reduction in contributions to company stock over the past decade. The coefficient on the share of options in the plan is the smallest for bond funds, but still highly significant. The smaller sensitivity for bond funds is not surprising given that fixed income funds are often chosen as the “default” investment for participants who do not make an active alternative selection.

Our results on the other variables are generally consistent with previous findings. Consistent with Benartzi (2001) and Brown et al. (2006), we find that employees at firms where the employer match is restricted to company stock direct, on average, 7.0 percentage points more of their own contributions to company stock. Only about one-third of this 7.0 percentage point increase comes out of allocations to other equity funds, while 44% comes out of fixed income investments. Prior research (e.g., Benartzi, 2001; Huberman and Sengmueller, 2004; Choi et al., 2004b; Agnew, 2006) suggests that individuals are more likely to invest in their employer’s stock if it has performed well in recent years. We also find that holdings of own employer stock are positively related to past 5 year returns on that stock, while the share of contributions directed toward other equity investments is significantly negatively related to own company stock performance. The company stock purchase rate is higher at less volatile firms, larger firms, and firms with higher market-to-book ratios (a proxy for growth opportunities). The presence of a defined benefit plan or an investment grade bond rating has little effect on participant investment decisions.

#### 4.4. Panel regression results

A potential concern with any cross-sectional regression is that there is tremendous heterogeneity across firms (and the workers across firms), and thus one might be concerned about spurious correlation, such as differences in risk tolerance across workers in different firms. To address this, we add firm-fixed effects to our regression specification. The inclusion of these 891 firm-specific fixed effects absorb all of the variation in the allocation of contributions that can be attributed to time-invariant differences in the characteristics of firms and their employees. In other words, with firm-fixed effects in place, the coefficient on the share of options in an asset class is identifying the relationship of interest from *within-firm changes over time* in the number of investment options offered.

The results of these fixed effects regressions are displayed in Table 5. By comparing the results with those obtained in the cross-sectional regressions presented in Table 4, two conclusions emerge. First, in general, pension plan parameters remain important determinants of investor behavior after controlling for firm-level fixed effects. Importantly, the influence of the number and mix of investment options on portfolio choice is still quite strong for equity funds. For example, controlling for firm-level fixed effects, the coefficient on the share of equity funds is highly significant 0.45 (compared to 0.70 in the cross-sectional regression). To put this coefficient into perspective, imagine a firm that began with three equity funds and two bond funds adds a fourth equity fund. Applying the 0.452 coefficient indicates that this change would be expected to increase the allocation of contributions to equity by 3.0 percentage points, which represents a

Table 5  
Regression of share of contributions against share of fund options, firm-fixed effects 1991–2000

	Share of contributions in:				
	Company stock fund	Domestic equity funds	International equity funds	Bond funds	Balanced funds
Share of fund options in asset class	0.269*** (0.093)	0.452*** (0.053)	0.317*** (0.109)	0.452*** (0.060)	0.443*** (0.121)
Co stock match required?	0.023 (0.019)	0.024 (0.016)	-0.010 (0.008)	-0.037** (0.017)	-0.003 (0.020)
Past 5 year return on company stock	0.005*** (0.002)	-0.003*** (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
S.D. of co. stock	-0.144 (0.228)	-0.062 (0.246)	-0.095 (0.173)	-0.180 (0.264)	-0.002 (0.230)
Market-to-book (q)	0.024*** (0.007)	-0.014*** (0.005)	-0.02 (0.004)	-0.008* (0.005)	-0.003 (0.003)
Ln (assets)	0.057*** (0.014)	-0.036*** (0.012)	0.002 (0.009)	-0.011 (0.014)	-0.011 (0.013)
DB plan?	0.005 (0.013)	0.002 (0.010)	-0.001 (0.009)	-0.005 (0.010)	-0.013* (0.008)
Investment grade bonds?	0.000 (0.013)	0.008 (0.011)	-0.005 (0.006)	-0.003 (0.014)	-0.008 (0.011)
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects?	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.875	0.868	0.808	0.828	0.797
# of observations	1935	1900	1045	1911	1065

Each column of this table represents a separate regression. The dependent variable is the share of contributions allocated to a particular asset class, and the regression is estimated for the sample of firms that offer at least one option in that asset class. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm. See text for further information.

\*, \*\*, and \*\*\* denote significance at the 0.10, 0.05, and 0.01 level respectively.

nontrivial change in the risk/return profile of participant portfolios. The coefficients on the share of options for international funds, bond funds, and balanced funds are of similar magnitude.

Second, firm-level heterogeneity is also an important determinant of how 401(k) assets are allocated, particularly in the context of company stock. While one cannot reject that there is a one-for-one relation between the fraction of contributions allocated to an employer's company stock and the fraction of options in the plan that are company stock (since company stock is one option, this fraction is simply 1/total plan options) in the cross section, the magnitude of this relation drops by over two-thirds once firm-specific fixed effects are included in the regression. This suggests that while in the cross section, firms with more options in their 401(k) plan contributed less to company stock, this in large part likely represents firm-level heterogeneity in the desirability of company stock investments (which manifests itself both in employee contributions to company stock as well as how many non-company stock options are present in the 401(k) plan) as opposed to a "1/n" behavioral response. This conclusion is supported by [Brown et al. \(2006\)](#) who find that firms that provide employer-matching contributions in company stock tend to offer fewer options in the 401(k) plan as well.

[Benartzi \(2001\)](#) finds evidence of an "endorsement" effect, that is, workers in firms where the employer provides a match in company stock tend to invest substantially *more* of their own contributions in company stock (and attributes this to the workers viewing a firm match in company stock as implicit investment advice). While we also found such a relation in the cross

section, the relation between match policy and employee contributions disappears once we control for firm-level fixed effects (the coefficient falls over 2/3 in magnitude and is no longer statistically significant).<sup>8</sup> Thus, investments in company stock in the pension plan appear to be driven in no small part by firm or worker-specific characteristics outside of the pension plan.

These results provide clear evidence that the number and mix of investment options matter in determining the equity/bond mix in retirement plans. An important policy implication of this finding is that the choice of investment options to make available in an individual accounts program is likely to have a first-order effect on the portfolio allocations that individuals make. This finding is not based on cross-sectional correlations, but rather is obtained from a panel data set, enabling us to control for heterogeneity in the investment preferences of workers across firms and across time.

#### 4.5. Robustness checks of panel regression results

The regression results in Table 5 were obtained in a firm-fixed effects framework. Thus, the coefficient on the share of options in an asset class is identifying the relationship of interest from *within-firm changes over time* in the number of investment options offered. We attribute the resulting correlation between the share of contributions and the share of options to a behavioral motivation (i.e., the “1/n” hypothesis or more generally that the mix of options “matters”). However, there are rational, alternative explanations for this result that we address in Table 6.

First, it may be the case that until the firm offers a broad-based equity index fund, additional equity options may actually expand the return-risk frontier for the participants (thus leading to greater contributions to equity funds). Once an index fund is in the plan, though, additional equity options should not “matter” for the participant, thus weakening the relation between the share of equity contributions and the share of equity options. Column (2) in Table 6 demonstrates that this is not the case, having an index option in the plan does not reduce the sensitivity of contributions to equity funds to the number of equity options in the plan (the interaction term with the share of equity options is insignificant).<sup>9</sup> Similarly, if the firm has only one equity option, then adding a second equity option might provide some sort of diversification that expands the return-risk frontier for the participants and thus leads to increased equity allocations. However, the addition of a fourth or fifth equity option is likely to provide no diversification benefit, and thus the relation between share of contributions and share of options should weaken with the number of equity options in the plan. Again, column (3) demonstrates that this is not the case, as the relation between the share of contributions and the share of options does not change with the number of equity options in the plan.

Another alternative explanation is that a change in equity options within a plan happens as a result of increased demand for equity that is just starting to surface in employee contributions within the plan. In other words, as demand for equities in the 401(k) plan grows, this leads to increased contributions to equity funds in aggregate, as well as the firm adding some additional equity funds. Thus, there is an omitted variable, the change in past equity demand, that really drives the (spurious) relation we observe between the share of equity options and the share of equity contributions. To control for this “demand” story, we also include the past change in the fraction of contributions to equity funds in the regression. Its inclusion has no effect on the

<sup>8</sup> Forty-two firms change match policy over the sample, enabling us to identify the match policy or “endorsement” effect in a firm-fixed effects regression.

<sup>9</sup> For ease of comparison, the first column of Table 6 replicates the fixed-effect coefficient on the share of equity options from Table 5.

Table 6  
Robustness of relation between contributions to equity funds and number of equity options

	Share of contributions in:					
	All domestic equity funds				Actively-managed equity funds	Equity index funds
	(1)	(2)	(3)	(4)	(5)	(6)
Share of fund options in asset Class	0.452*	0.492***	0.441***	0.428***	0.508***	0.416***
	(0.053)	(0.061)	(0.068)	(0.069)	(0.063)	(0.133)
Share of options that are equity funds * (have equity index fund)		-0.041 (0.030)				
Share of options that are equity funds * (have 3–4 equity options)			0.041 (0.029)			
Share of options that are equity funds * (have 5+ equity options)			-0.013 (0.036)			
Change in share of contributions to equity funds during prior year (share in year t-1 less share in year t-2)				0.006 (0.036)		
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.868	0.869	0.870	0.892	0.863	0.875
# of observations	1,900	1,900	1,900	879	1,797	898

Each column of this table represents a separate regression. The dependent variable is the share of contributions allocated to a particular asset class, and the regression is estimated for the sample of firms that offer at least one option in that asset class. All regressions also include all the other variables listed in Tables 4 and 5. The robust standard errors, which are reported in parentheses, are clustered on each firm in order to account for correlation across time for a given firm. See text for further information.

\*, \*\*, and \*\*\* denote significance at the 0.10, 0.05, and 0.01 level respectively.

coefficient of interest, than on the share of equity options, while the coefficient on the change in past contributions to equity funds is itself small in magnitude and insignificant (see column (4)).

Finally, up to this point, we have lumped both actively-managed funds and index funds together. Columns (5) and (6) present regression results examining these types of equity funds separately. We find that for both types of equity funds, the share of funds of their type in the plan affects investment decisions. For example, suppose a firm has one equity index fund, one bond fund, and company stock as investment options. If that firm adds four actively-managed equity funds to the mix, allocations to the index fund will be predicted to fall by 7.9 percentage points (coefficient of 0.416 multiplied by (0.33–0.14)).

After having established a robust relation between the mix of options in 401(k) plans and investment decisions we next consider how trends in the mutual fund industry have affected pension plans. In particular, we consider whether the increased number of actively-managed equity funds over the past 10 years has trickled down to 401(k) plans, and how it has affected the expenses and performance of participants in their retirement plans.

## 5. Index versus actively-managed funds

As referenced earlier, the number of mutual funds available to investors in the U.S. has grown dramatically, driven by the surge in equity funds (particularly actively-managed) over the past decade. The mutual fund literature (e.g., Jensen, 1968; Malkiel, 1995; Gruber, 1996; Carhart, 1997; Daniel et al., 1997) finds that actively-managed funds charge substantially higher annual

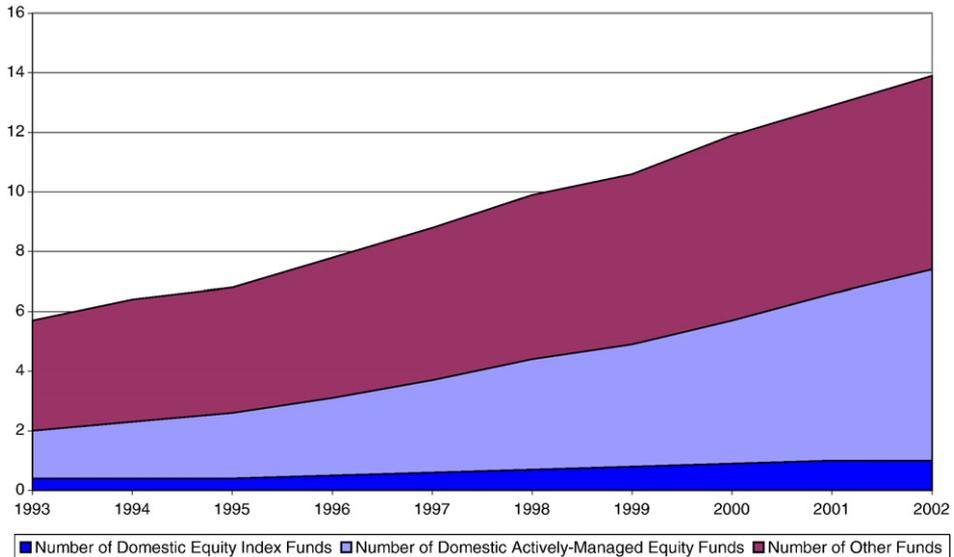


Fig. 2. Average number of investment options in sample of 401(k) plans, 1993–2002.

fees than do index funds (such as S&P 500 funds), without earning higher after-expense returns on average (and perhaps perform no better before expenses). Do trends in 401(k) plan fund offerings mirror the aggregate trends in the mutual fund industry? If so, this raises the concern that change in the composition of investment options offered in 401(k) plans could result in more money being allocated to high-cost funds that will on average result in lower net returns.

To address these questions, we augment our 11-k data set described in Section 3. In particular, we follow the firms that had 11-k data during 1998 in the original sample over the next four years (1999–2002). This enables us to better assess trends in 401(k) plans over a longer time series. One disadvantage of the later data is that we are restricted to looking at the allocation of asset balances rather than the flow of contributions, but this will not be an issue for the analyses we conduct below.<sup>10</sup>

In Fig. 2, we see that the average number of options in 401(k) plans has increased from just below 6 options in 1993 to 14 options in 2002. Over that period, the average number of actively-managed equity funds in the plan has dramatically increased from 1.6 in 1993 to 6.4 in 2002, while the number of index funds offered in 401(k) plans only increased slightly over the period and still remains very small (averaging no more than one option in the plan over every year in the sample).

Fig. 3 confirms that the vast majority of new funds (two-thirds) added to 401(k) plans over 1998–2002 are actively-managed equity funds (mirroring the broader trends in the mutual fund industry), while a mere 8% of the new options represent an index fund (typically introducing an S&P fund for the first time or adding a small-cap index fund to a S&P 500 fund already in place). Coupled with our earlier findings in Section 4, this trend in new fund offerings has strong implications for the relation between the investment performance of these retirement plans and the number of fund options provided.

<sup>10</sup> The reason for the difference between the pre-1999 and the 1999–2002 data is that the SEC changes the reporting requirements on the 11-k.

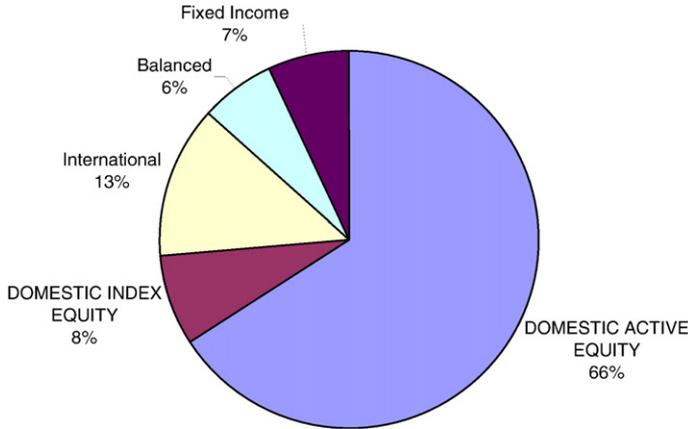


Fig. 3. Share of new options added to 401(k) plans, 1998–2002.

Of course, investors interested in low cost index funds really only need one broad market index, and thus it is possible that the majority of allocations flow to this low-cost option (as opposed to the higher-cost actively-managed alternatives). Our previous regression results in Tables 4, 5, and 6 suggest this is unlikely to be the case, and Table 7 confirms this. In Table 7, we demonstrate that the share of equity options in the plan comprised of actively-managed funds increases with an increase in the total number of equity funds in the plan, as does the fraction of equity assets held in actively-managed funds. Regression analysis (not reported) confirms that the share of assets in actively-managed funds (index funds) increases (decreases) substantially with the number of total equity funds in the plan. This result is consistent with the notion that the burgeoning number of actively-managed funds makes it harder for investors to find the lower-cost index fund in the plan (with less money flowing to this option as a result).

Of interest is the “quality” of the actively-managed equity funds offered in the 401(k) plans relative to the index funds offered. To provide an initial sense of the “quality” of the actively-

Table 7  
Composition of domestic equity options and contributions to equity funds in 401(k) plans, 1991–2002

Total # of domestic equity fund options offered by plan	Share of domestic equity options in:		Share of domestic equity assets in:	
	Actively-managed funds	Index funds	Actively-managed funds	Index funds
1	0.77	0.23	0.77	0.23
2	0.80	0.20	0.79	0.21
3	0.81	0.19	0.80	0.20
4	0.83	0.17	0.80	0.20
5	0.84	0.16	0.80	0.20
6	0.85	0.15	0.81	0.19
7	0.86	0.14	0.81	0.19
8	0.88	0.12	0.83	0.17
9	0.89	0.11	0.85	0.15
10	0.88	0.12	0.82	0.18
11+	0.90	0.10	0.84	0.16

Data from 11-k forms. The number of domestic equity options in, share of domestic equity options in, and share of domestic equity assets in actively-managed funds and index funds represents the average across firm–year observations. See text for further information.

Table 8

Difference in performance and costs of actively-managed funds relative to index funds in 401(k) plans, 1991–2002

Difference in performance and costs of actively-managed funds relative to index funds (returns and expenses are reported in % on an annualized basis, Morningstar Percentile Rankings are scaled from 0 to 100 where 0 is the worst performer and 100 is the best performer)				
Controls	Past five-year gross return (before expenses)	Expenses	Past five-year net return (after expenses)	Morningstar Percentile Ranking within objective (based on past 5-year net returns)
None	-0.61 (0.51)	0.60**** (0.05)	-1.37** (0.54)	-9.4*** (2.7)
Year and firm-fixed effects	-0.08 (0.30)	0.53*** (0.03)	-0.72** (0.31)	-8.3*** (2.3)

Regressions of performance and cost differences across domestic actively-managed and domestic index equity funds are estimated at the fund-year level (i.e., the unit of observation is a fund offering in a given firm plan in a given year) for a sample of 401(k) plans from 1991–2002. The past five-year gross return regression is based on 15067 fund-year observations, the expense regression is based on 17599 fund-year observations, the past five-year net return regression is based on 15161 fund-year observations, and the Morningstar Percentile Ranking regression is based on 15153 fund-year observations. Because of the difference in sample sizes, the difference in gross return minus the difference in expenses, need not equal the difference in net returns. The robust standard errors, which are reported in parentheses, are clustered at the fund level. See text for further information.

\*, \*\*, and \*\*\* denote significance at the 0.10, 0.05, and 0.01 level respectively.

managed relative to the index funds (at least as measured by their past long-term performance and annual costs) we present in Table 8 differences in the following variables: past five-year returns before expenses, expenses, past five-year returns after expenses, and percentile ranking of the fund based on its past five-year returns (after expenses) within its investment objective (such as small-cap growth) as determined by Morningstar.<sup>11</sup> Table 8 demonstrates that while the actively-managed and index equity funds offered in our sample of 401(k) plans have similar performance *before* accounting for expenses (index funds actually slightly outperformed, but the difference is not significant), they differ significantly in their reported annual expenses (on the order of 50 basis points per year), which leads to worse performance after accounting for expenses (both in terms of returns and percentile rankings within its investment objective).

Table 9 conducts a similar analysis at the firm level. For each firm–year observation, we calculate the average expenses across all the domestic equity options in the plan as well as the average Morningstar Percentile Rankings for performance over the next year. We relate these variables to the fraction of domestic equity funds in the 401(k) plan that is actively managed, controlling for both firm-specific and year fixed effects. The results suggest that switching from all index equity funds to all actively-managed equity funds increases the firm-level average expenses for equity funds by between 36 to 47 basis points per year, and thus reduces the firm-level average performance ranking of its equity funds over the next year by 15 percentage points in the Morningstar Percentile Rankings.

Given historically that actively-managed funds do not outperform index funds (perhaps even before expenses), these investment patterns (coupled with the composition of the new funds offered) could result in a nontrivial reduction in resources available for retirement. For example,

<sup>11</sup> These variables are provided by merging our sample of 401(k) fund offerings with the CRSP and Morningstar mutual fund databases. Morningstar percentile rankings are scaled from 0 to 100 where 0 is the worst performer and 100 is the best performer.

Table 9

Regression of expenses and performance of domestic equity allocations within 401(k) plans by fraction of domestic equity funds that are actively-managed, 1991–2002

	Firm-level average expenses for equity funds in plan (in %)		Firm-level average Morningstar Percentile Rankings for performance over the next year for equity funds in plan (in percentage points)	
	Unweighted	Weighted by fund assets	Unweighted	Weighted by fund assets
Fraction of equity funds that are actively managed	0.47*** (0.06)	0.36*** (0.06)	-15.2*** (3.5)	-15.5*** (3.7)
Year and firm-fixed effects?	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.753	0.757	0.254	0.254
# of observations	3842	3842	3824	3824

\*, \*\*, and \*\*\* denote significance at the 0.1, 0.05, and 0.01 levels, respectively.

Regressions of average expenses of domestic equity funds within a 401(k) plan and the average Morningstar Percentile Ranking of domestic equity funds within a 401(k) plan are presented. Morningstar Percentile Rankings are scaled from 0 to 100 where 0 is the worst performer and 100 is the best performer and are based upon performance of the fund over the next year within its objective. The robust standard errors, which are reported in parentheses, are clustered at the firm level. See text for further information.

consider a worker who starts at age 22 earning \$30,000 per year and experiences 4% nominal annual earnings growth until they retire at age 62. Suppose this worker saves 6% of salary per year in a 401(k) and receives a matching contribution equal to 3% of salary. If this individual earns an 8% nominal net return on their investments, she would have \$1.142 million at retirement. If, instead, this individual received nominal annual net returns that were 35 basis points lower than this, or 7.65%, she would have only \$1.065 million at retirement. In short, due to the power of compounding, a 0.35% per year difference in annual returns accumulates to a nontrivial 7.5% difference in terminal wealth at retirement. The fact that individual investors may not be fully considering the important role that expenses play in reducing their retirement wealth is consistent with the findings of Choi et al. (2006) who show that highly educated subjects (Harvard undergrads and Wharton MBAs) are surprisingly unresponsive to differences in expense ratios when selecting a mutual fund, even when the underlying investment is otherwise nearly identical.

## 6. Conclusions

A key policy issue in the design and implementation of any defined contribution pension system, whether publicly or privately provided, is how to structure the investment options that will be made available to participants. While it is well understood that the structure of investment options can have an important effect on the level of administrative expenses of an individual accounts program, we show that the number and mix of investment options can also have a first order effect on the risk and return profile of average portfolios. Even after controlling for individual firm and year fixed effects, we find a strong positive relationship between the share of investment options provided to employees in a particular asset class and the share of their portfolios invested in that asset class. This strongly suggests that average participants are not optimally allocating their portfolios according to standard finance theory predictions, but instead are following naïve strategies that subject them to “manipulation” by non-binding changes in the number and mix of investment options. A key policy

implication is that the number and mix of investment options will have an important effect on overall asset allocation in the individual accounts. In short, it appears to be possible to influence the portfolio allocation of individual participants by altering the mix of equity and bond funds, even if the overall investment opportunity set remains unchanged.

By exploiting panel data on 401(k) plans, we find that both plan parameters and firm-level heterogeneity are important in explaining investment decisions. Investments in company stock, in particular, seem to be driven more by differences in workers across firms (or unobserved differences in the firms themselves) than by cross-sectional differences in pension plan characteristics (such as whether the match is in company stock or the number of non-company stock options in the retirement plan). This highlights the importance of exploiting panel data in identifying behavioral responses to pension plan characteristics.

Finally, the proliferation of actively-managed equity funds in general, which has trickled down to offerings in 401(k) plans as well, has resulted in the vast majority of money in retirement plans flowing into higher-cost actively-managed equity funds as opposed to lower-cost equity index funds (such as S&P 500 funds). This results in plan participants paying higher fees, which will depress overall portfolio performance, and thus, in the long-term, depress retirement wealth.

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